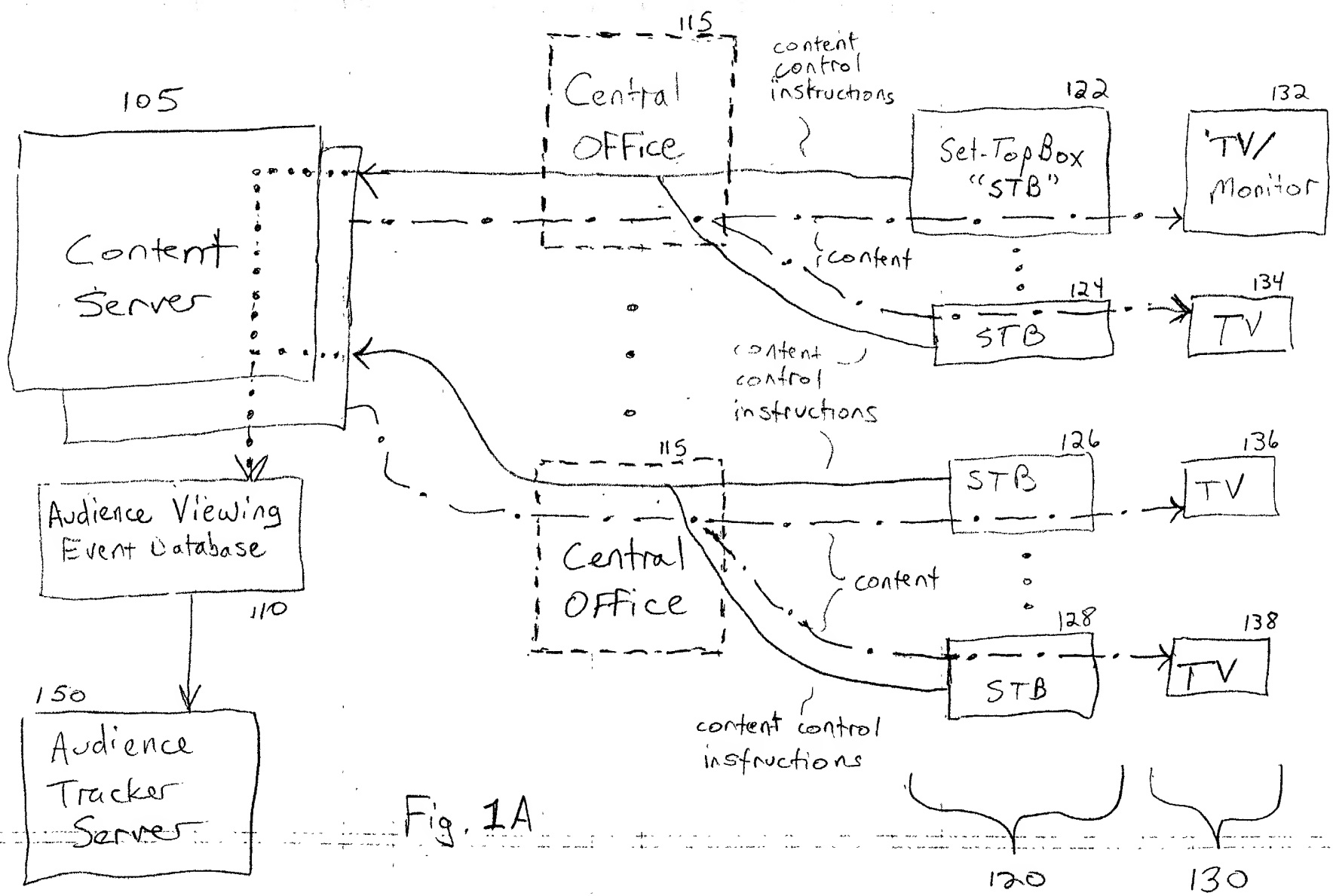
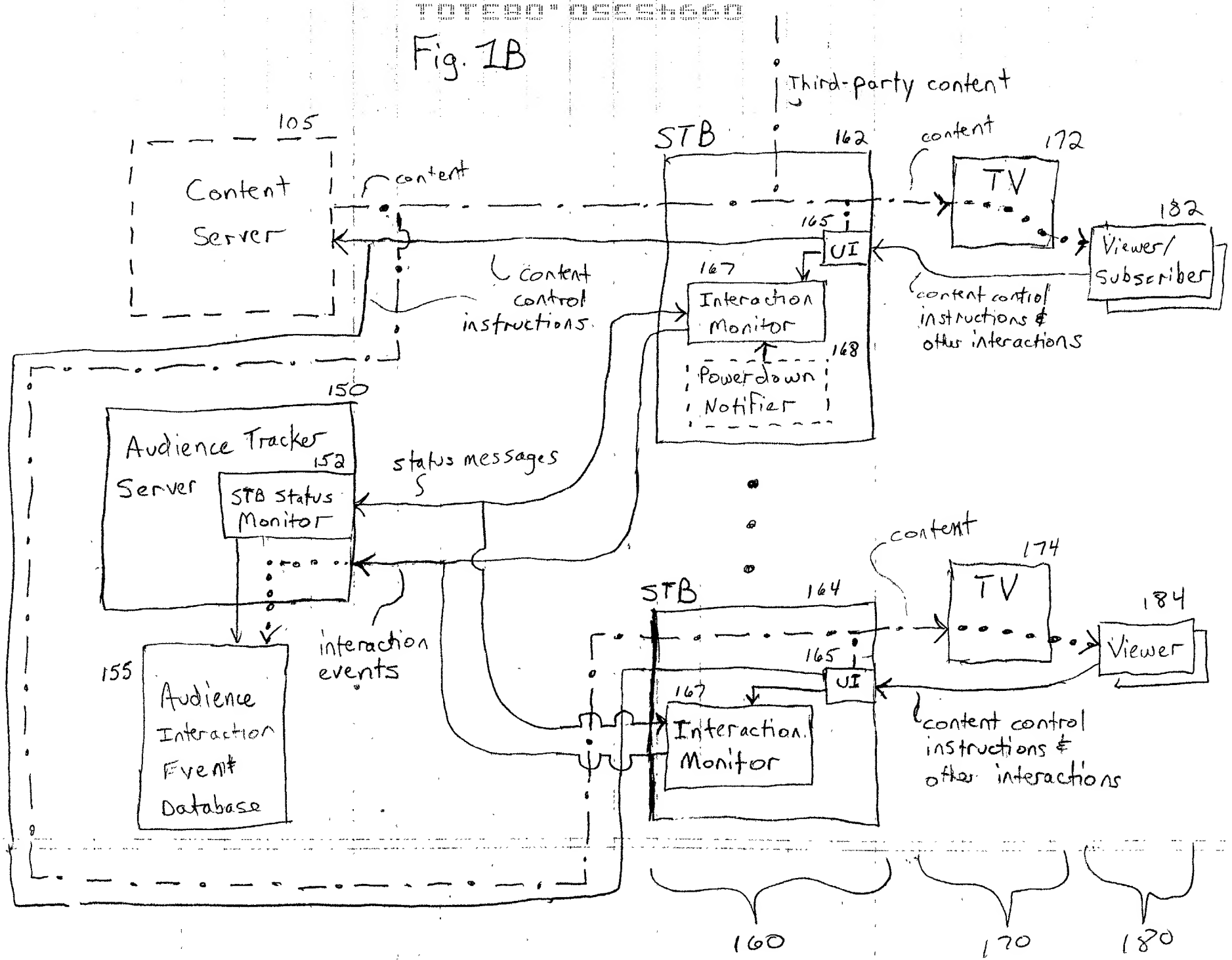

105
Content Server
115
Central Office
content control instructions
122
Set-Top Box "STB"
132
TV/ Monitor
content
124
STB
134
TV
content control instructions
115
Central Office
126
STB
136
TV
content
128
STB
138
TV
content control instructions
Audience Viewing Event Database
110
150
Audience Tracker Server
120
130

Fig. 1A

Fig. 1B


Third-party content
105
Content Server
content
STB
162
content
172
TV
182
Viewer/ Subscriber
165
UI
167
Interaction Monitor
168
Powerdown Notifier
content control instructions
content control instructions & other interactions
150
Audience Tracker Server
152
STB status Monitor
status messages
interaction events
155
Audience Interaction Event Database
STB
164
content
174
TV
184
Viewer
165
UI
167
Interaction Monitor
content control instructions & other interactions
160
170
180

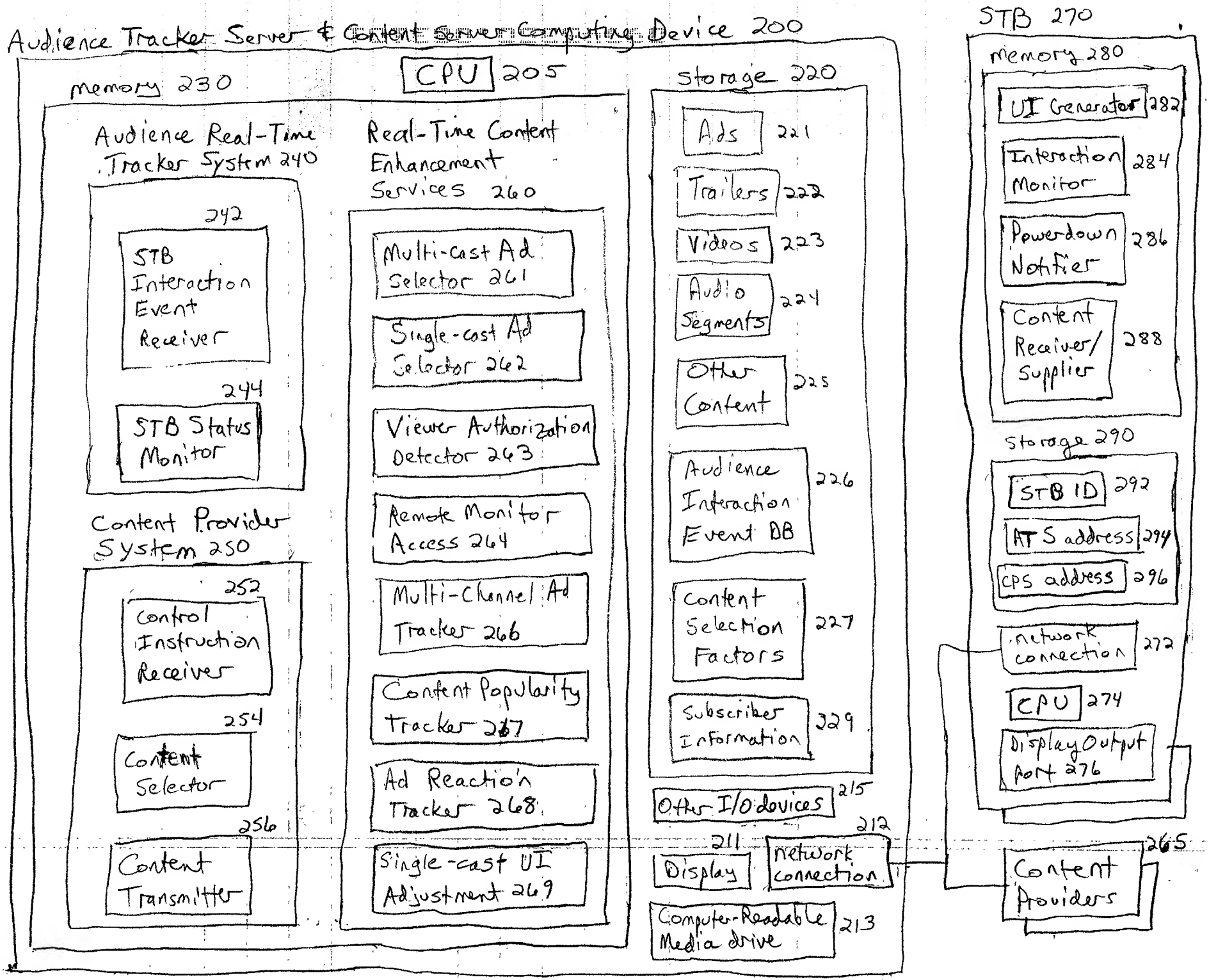
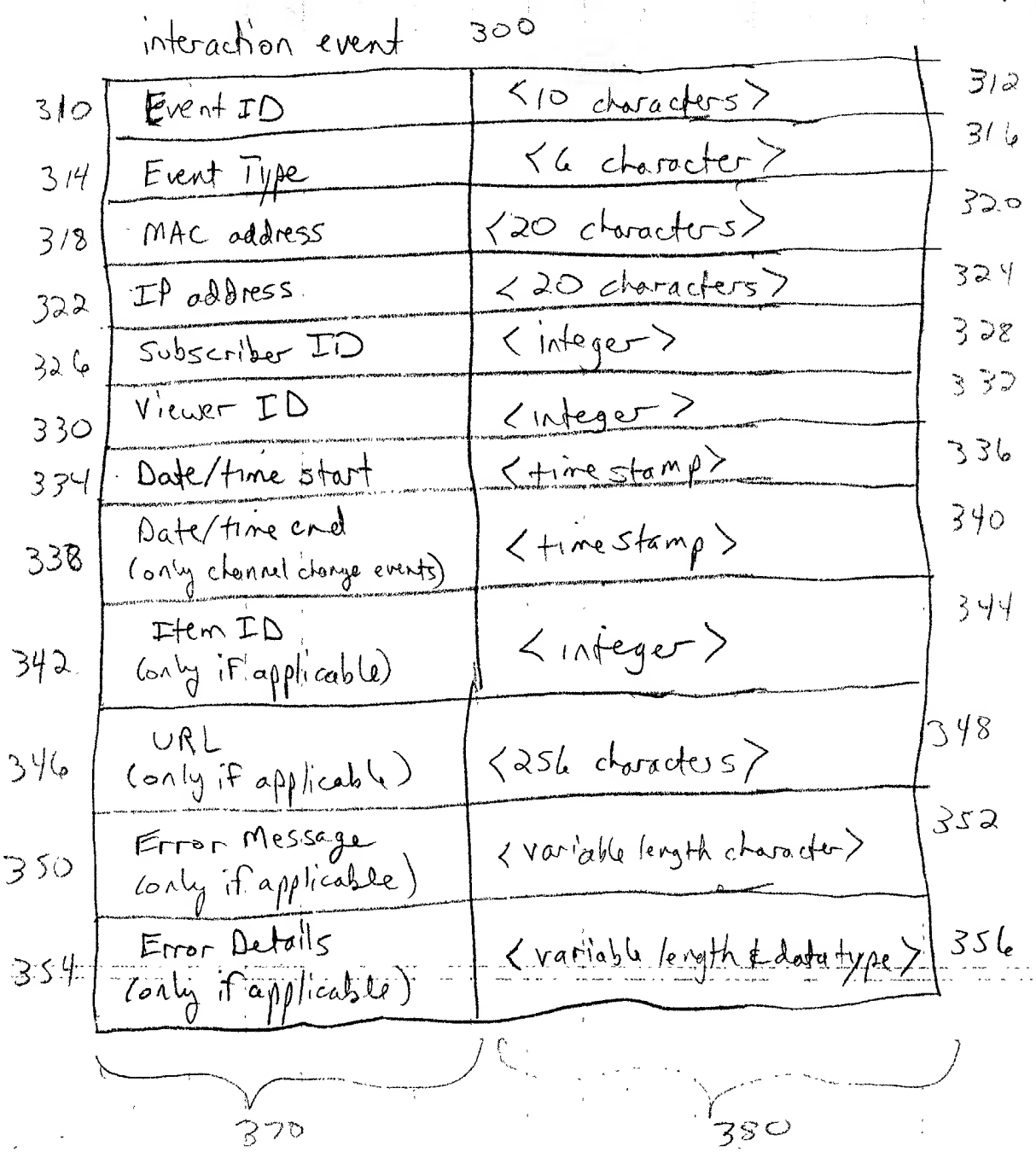

Audience Tracker Server & Content Server Computing Device 200
CPU 205
memory 230
Audience Real-Time Tracker System 240
242
STB Interaction Event Receiver
244
STB Status Monitor
Content Provider System 250
252
Control Instruction Receiver
254
Content Selector
256
Content Transmitter
Real-Time Content Enhancement Services 260
Multi-cast Ad Selector 261
Single-cast Ad Selector 262
Viewer Authorization Detector 263
Remote Monitor Access 264
Multi-Channel Ad Tracker 266
Content Popularity Tracker 267
Ad Reaction Tracker 268
Single-cast UI Adjustment 269
storage 220
Ads 221
Trailers 222
Videos 223
Audio Segments 224
Other Content 225
Audience Interaction Event DB 226
Content Selection Factors 227
Subscriber Information 229
Other I/O devices 215
Display 211
network connection 212
Computer-Readable Media drive 213
STB 270
memory 280
UI Generator 282
Interaction Monitor 284
Powerdown Notifier 286
Content Receiver/ Supplier 288
storage 290
STB ID 292
ATS address 294
CPS address 296
network connection 272
CPU 274
Display Output Port 276
Content Providers 265

Fig. 2

Fig. 3


interaction event
300
310
Event ID
<10 characters>
312
314
Event Type
<4 character>
316
318
MAC address
<20 characters>
320
322
IP address
<20 characters>
324
326
Subscriber ID
<integer>
328
330
Viewer ID
<integer>
332
334
Date/time start
<timestamp>
336
338
Date/time end
(only channel change events)
<timestamp>
340
342
Item ID
(only if applicable)
<integer>
344
346
URL
(only if applicable)
<256 characters>
348
350
Error Message
(only if applicable)
<variable length character>
352
354
Error Details
(only if applicable)
<variable length & data type>
356
370
380

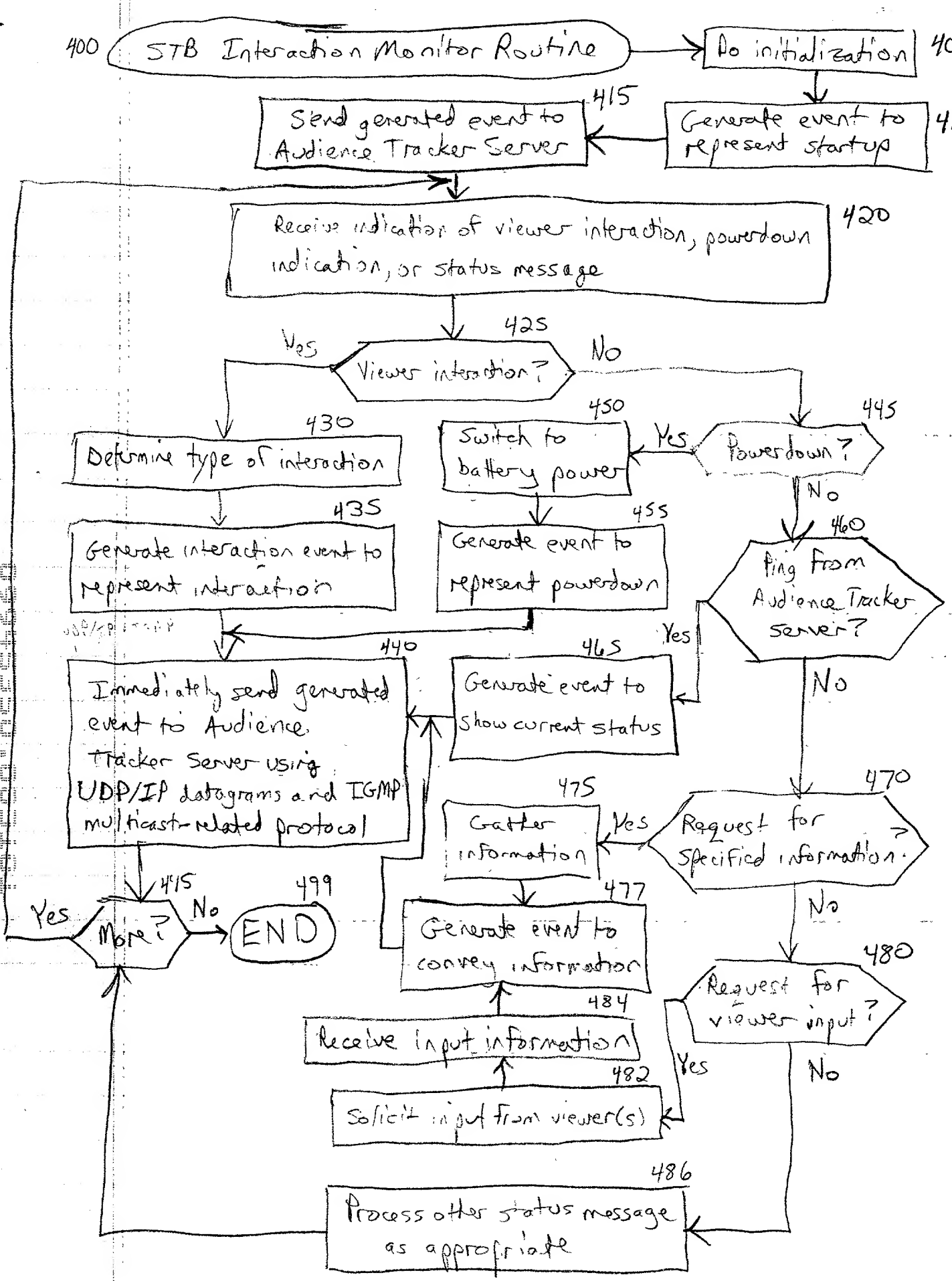

400
STB Interaction Monitor Routine
Do initialization
405
Generate event to represent startup
410
Send generated event to Audience Tracker Server
415
Receive indication of viewer interaction, powerdown indication, or status message
420
Viewer interaction?
425
Yes
No
Determine type of interaction
430
Generate interaction event to represent interaction
435
Powerdown?
445
Switch to battery power
450
Generate event to represent powerdown
455
Ping from Audience Tracker server?
460
Immediately send generated event to Audience Tracker Server using UDP/IP datagrams and IGMP multicast-related protocol
440
Generate event to show current status
465
Request for specified information?
470
Gather information
475
Generate event to convey information
477
Request for viewer input?
480
Receive input information
484
Solicit input from viewer(s)
482
Process other status message as appropriate
486
More?
415
END
499

Fig. 4

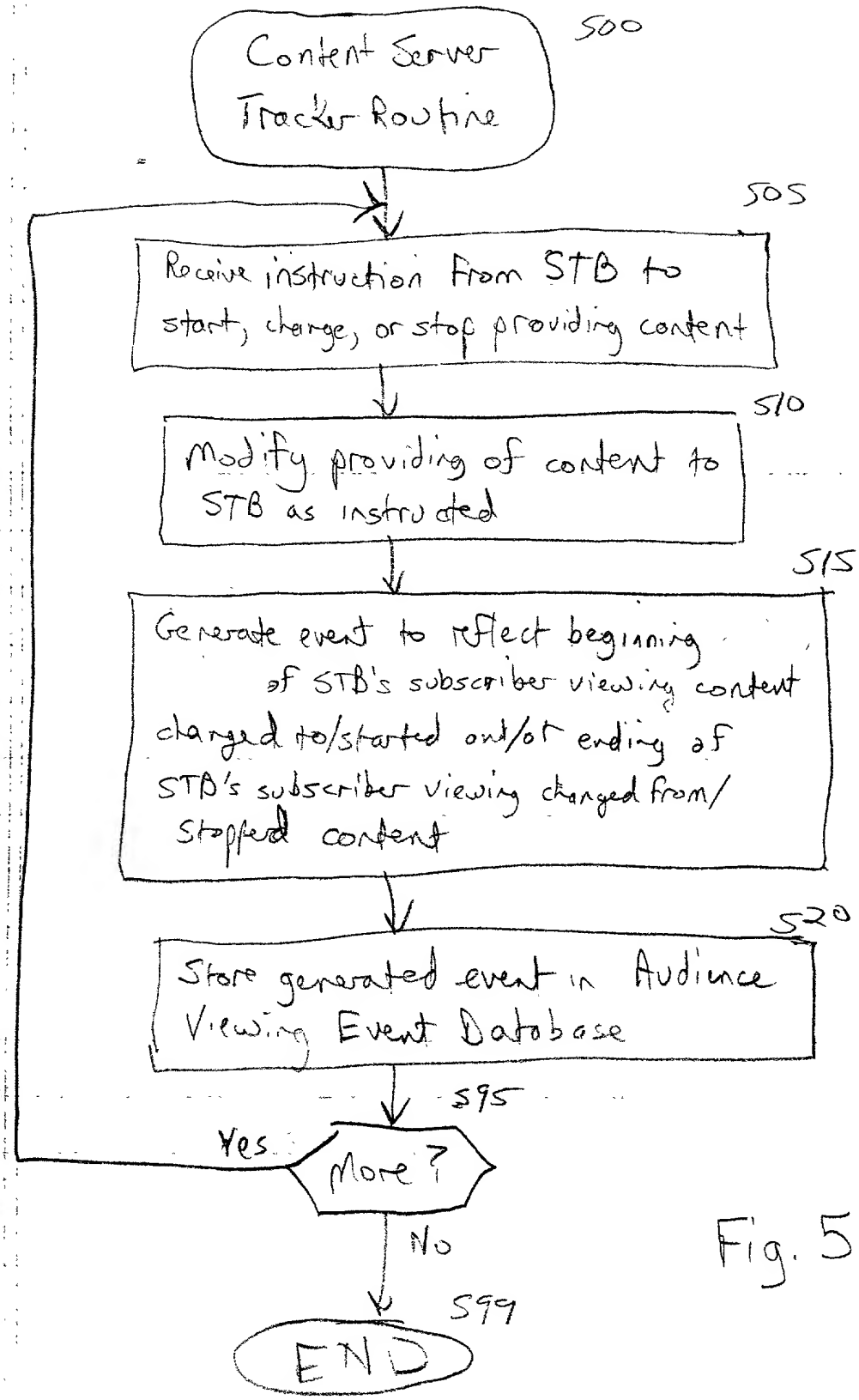

Content Server Tracker Routine
500
505
Receive instruction from STB to start, change, or stop providing content
510
Modify providing of content to STB as instructed
515
Generate event to reflect beginning of STB's subscriber viewing content changed to/started and/or ending of STB's subscriber viewing changed from/ stopped content
520
Store generated event in Audience Viewing Event Database
595
Yes
More?
No
599
END

Fig. 5

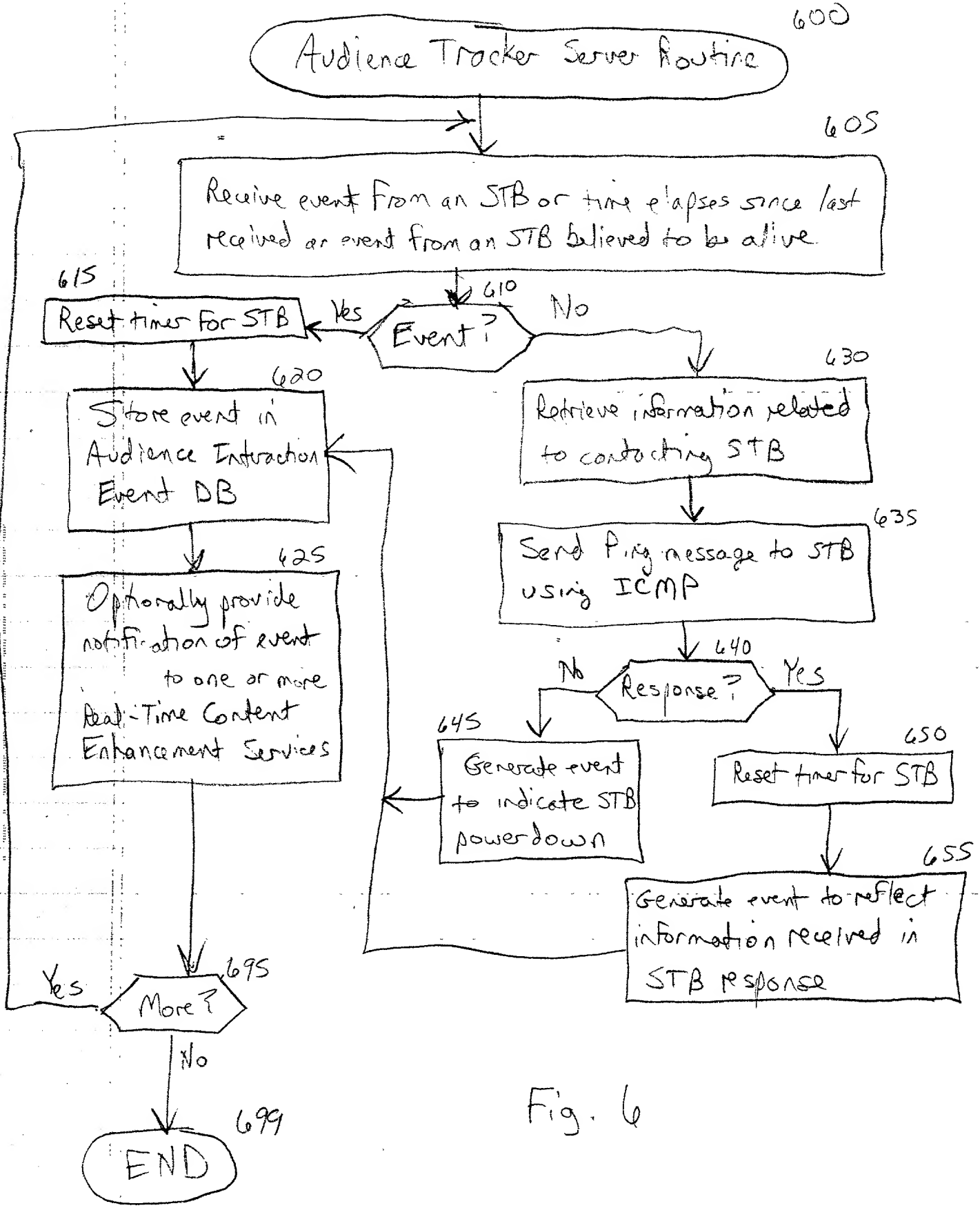

600
Audience Tracker Server Routine
605
Receive event From an STB or time elapses since last received an event from an STB believed to be alive
610
Event?
Yes
No
615
Reset timer For STB
620
Store event in Audience Interaction Event DB
625
Optionally provide notification of event to one or more Real-Time Content Enhancement Services
630
Retrieve information related to contacting STB
635
Send Ping message to STB using ICMP
640
Response?
No
Yes
645
Generate event to indicate STB powerdown
650
Reset timer for STB
655
Generate event to reflect information received in STB response
695
More?
Yes
No
699
END

Fig. 6

Fig. 7

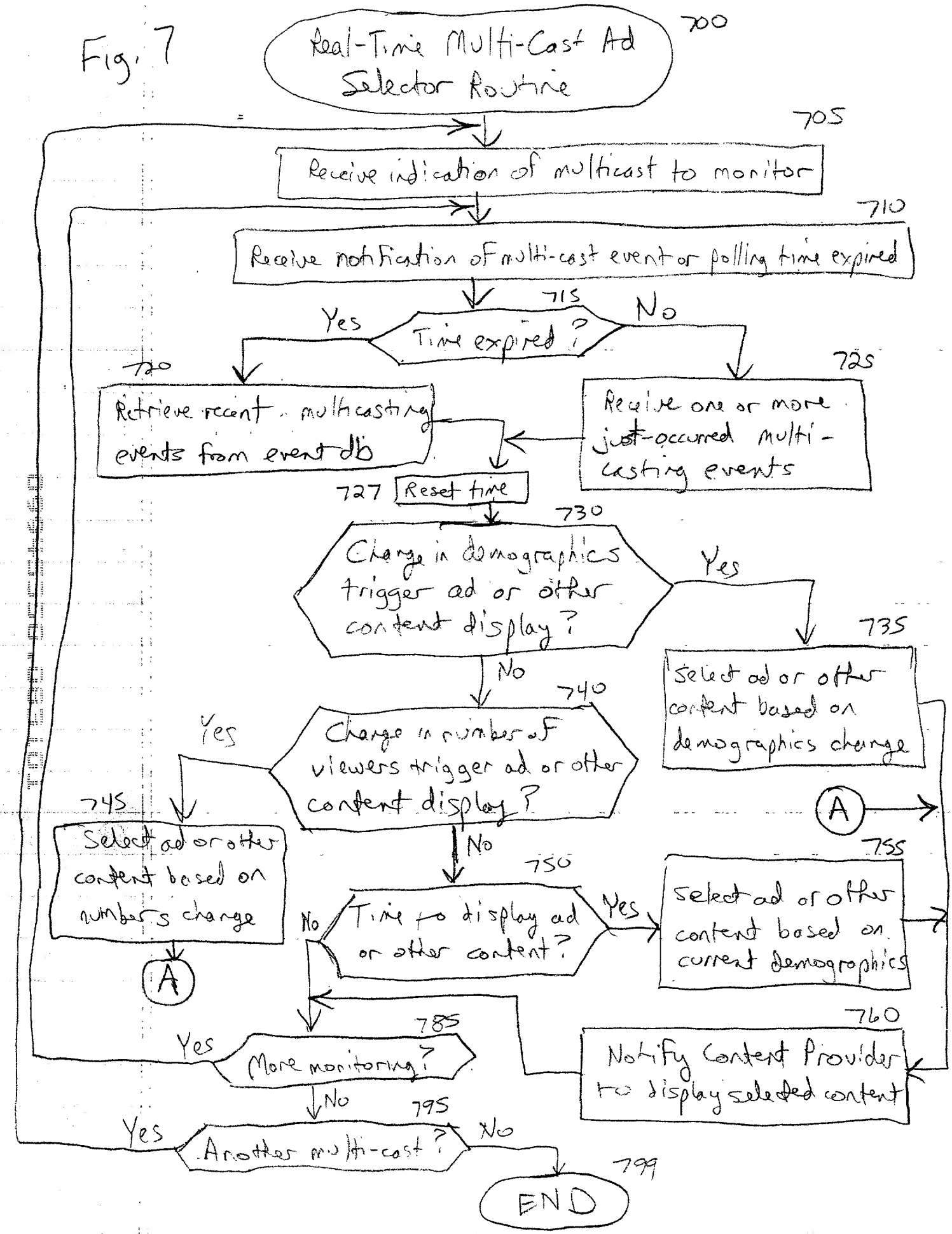
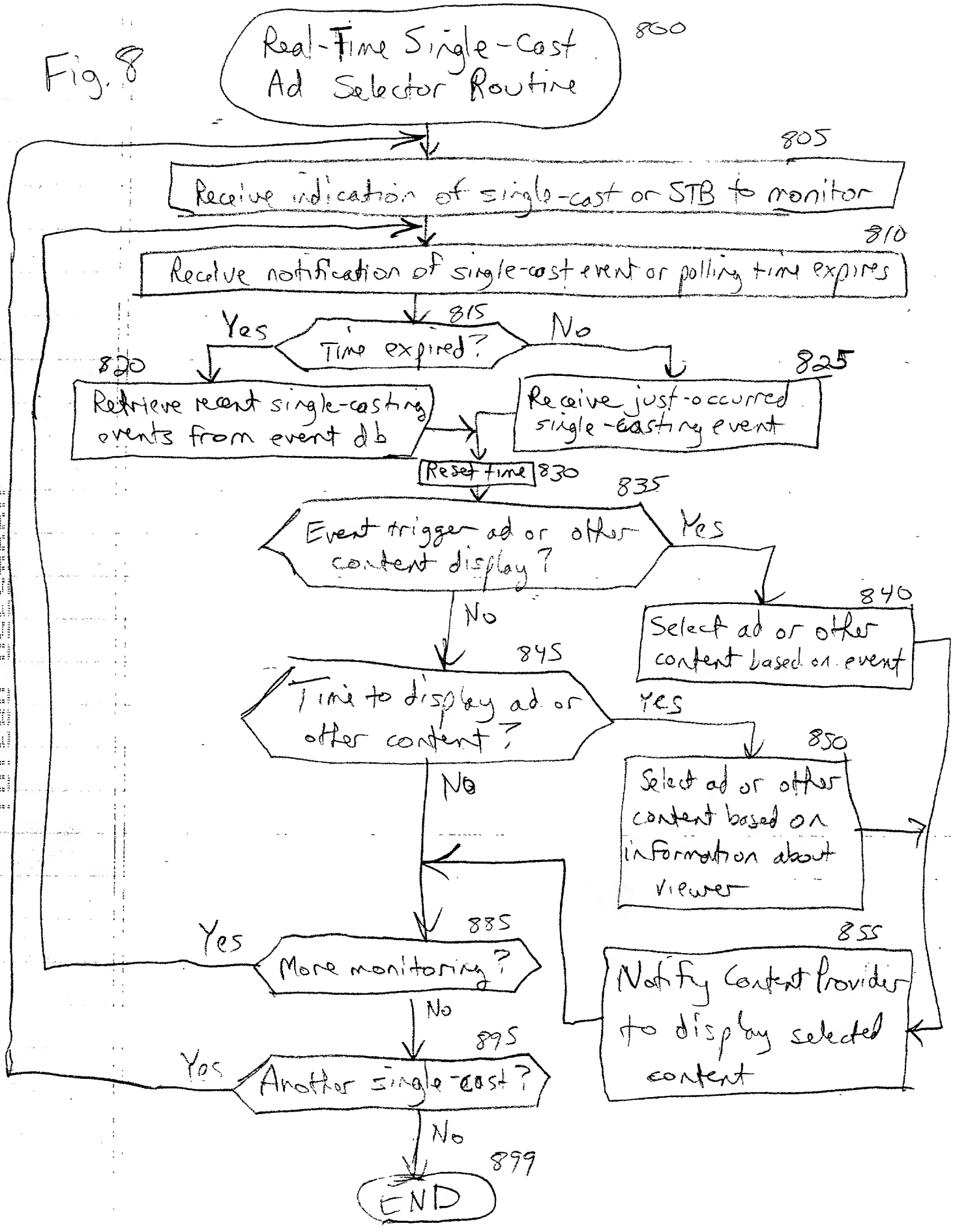
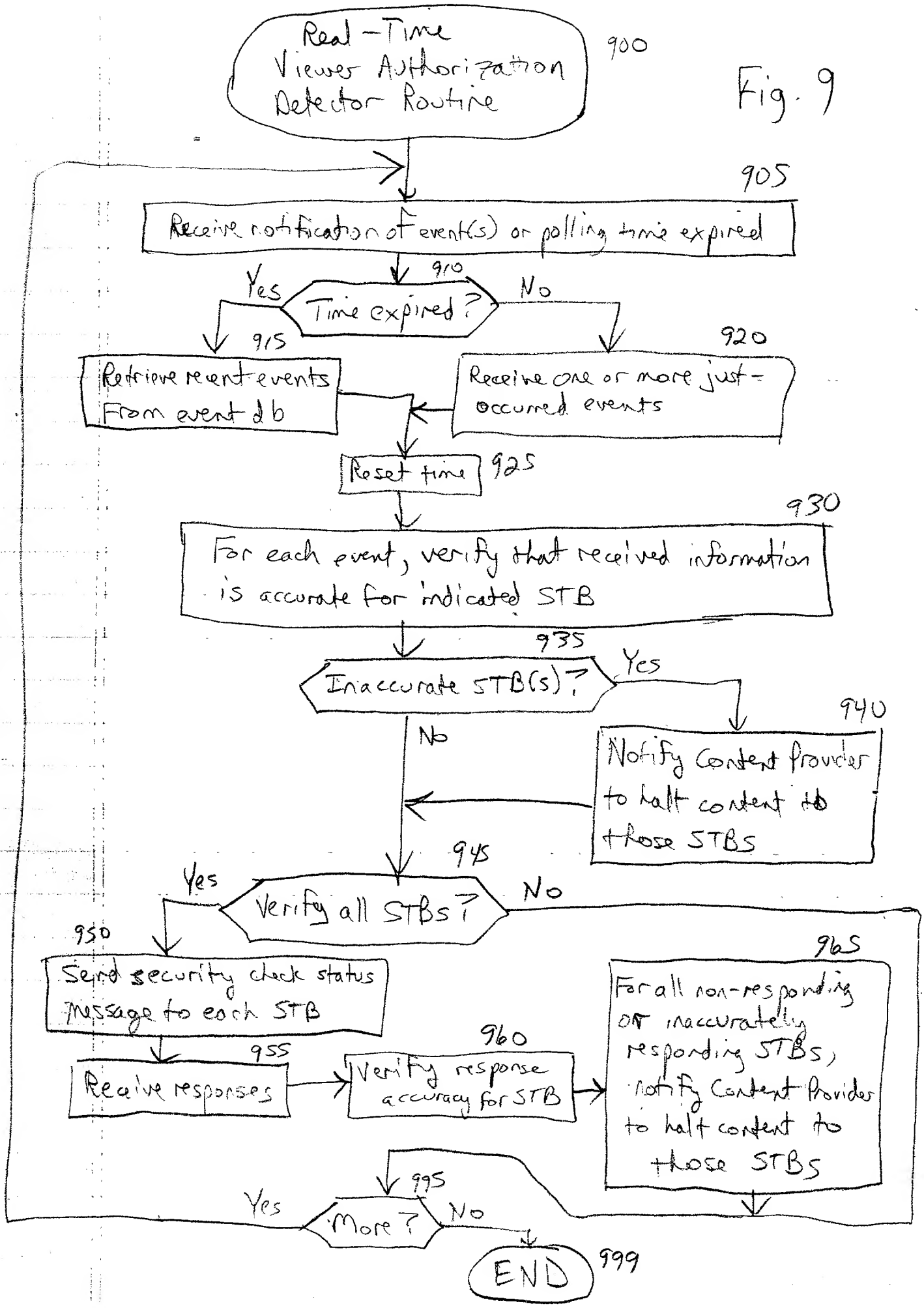

Real-Time Multi-Cast Ad Selector Routine
700
705
Receive indication of multicast to monitor
710
Receive notification of multi-cast event or polling time expired
715
Time expired?
Yes
No
720
Retrieve recent multicasting events from event db
725
Receive one or more just-occurred multi-casting events
727
Reset time
730
Change in demographics trigger ad or other content display?
Yes
735
Select ad or other content based on demographics change
No
740
Change in number of viewers trigger ad or other content display?
Yes
745
Select ad or other content based on numbers change
A
No
750
Time to display ad or other content?
No
Yes
755
Select ad or other content based on current demographics
760
Notify Content Provider to display selected content
785
More monitoring?
Yes
No
795
Another multi-cast?
Yes
No
799
END

Fig. 8


Real-Time Single-Cast Ad Selector Routine
800
805
Receive indication of single-cast or STB to monitor
810
Receive notification of single-cast event or polling time expires
815
Time expired?
Yes
No
820
Retrieve recent single-casting events from event db
825
Receive just-occurred single-casting event
Reset time
830
835
Event trigger ad or other content display?
Yes
No
840
Select ad or other content based on event
845
Time to display ad or other content?
Yes
No
850
Select ad or other content based on information about viewer
885
More monitoring?
Yes
No
855
Notify Content Provider to display selected content
895
Another single-cast?
Yes
No
899
END


Real-Time Viewer Authorization Detector Routine
900
Fig. 9
905
Receive notification of event(s) or polling time expired
910
Time expired?
Yes
No
915
Retrieve recent events From event db
920
Receive one or more just-occured events
925
Reset time
930
For each event, verify that received information is accurate for indicated STB
935
Inaccurate STB(s)?
Yes
No
940
Notify Content Provider to halt content to those STBs
945
Verify all STBs?
Yes
No
950
Send security check status message to each STB
955
Receive responses
960
Verify response accuracy for STB
965
For all non-responding or inaccurately responding STBs, notify Content Provider to halt content to those STBs
995
More?
Yes
No
END
999

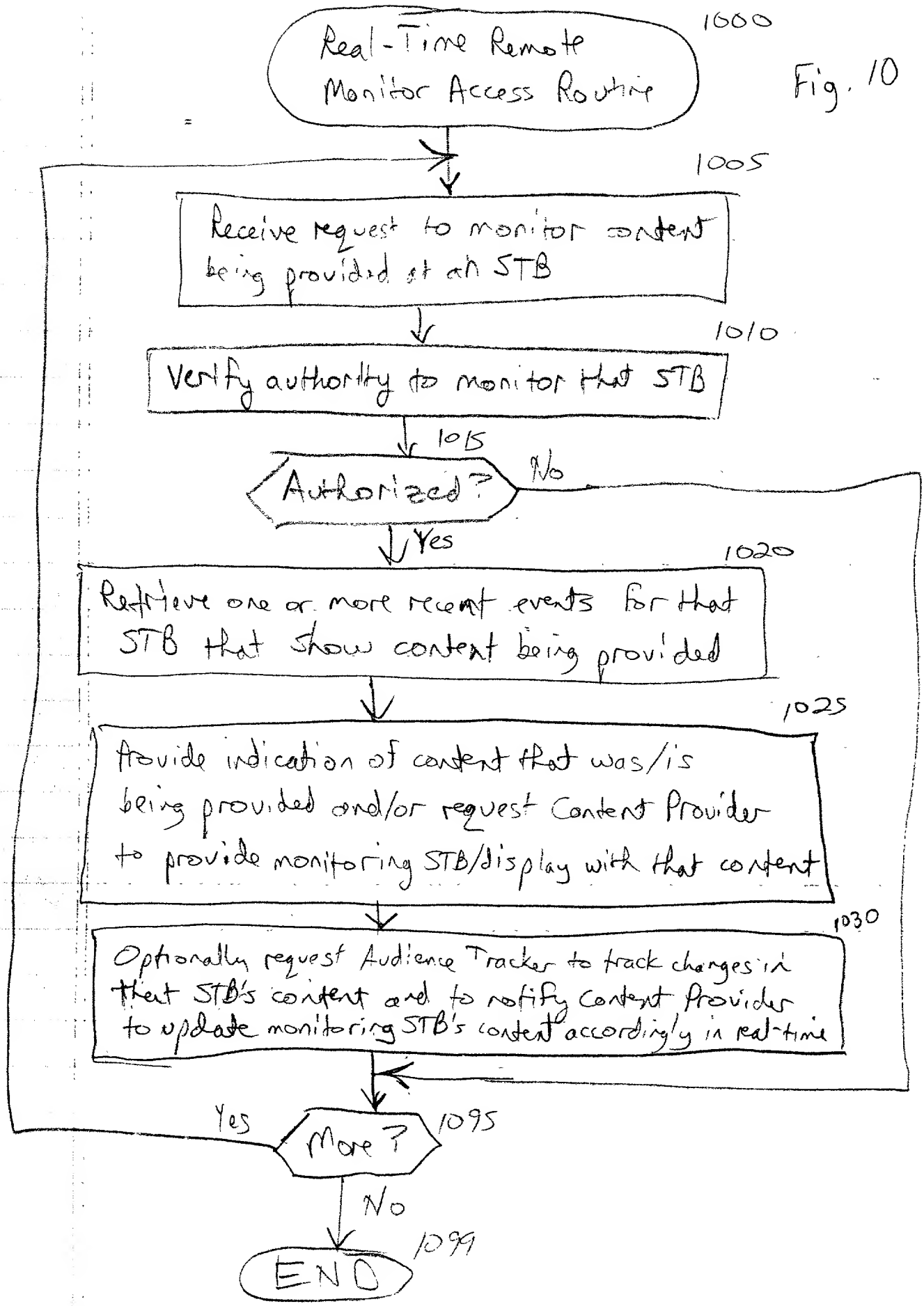
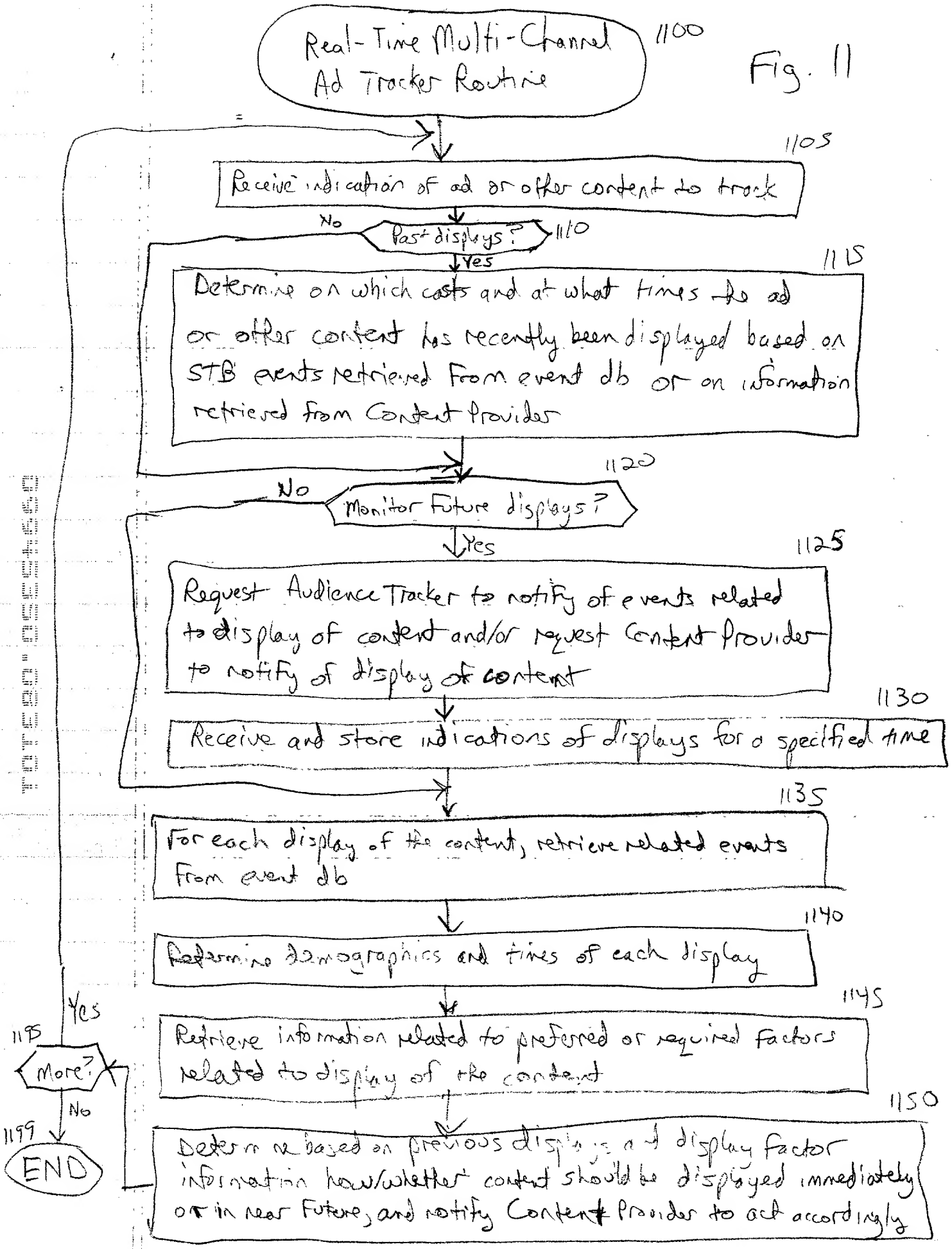

Real-Time Remote Monitor Access Routine
1000
1005
Receive request to monitor content being provided at an STB
1010
Verify authority to monitor that STB
1015
Authorized?
No
Yes
1020
Retrieve one or more recent events for that STB that show content being provided
1025
Provide indication of content that was/is being provided and/or request Content Provider to provide monitoring STB/display with that content
1030
Optionally request Audience Tracker to track changes in that STB's content and to notify Content Provider to update monitoring STB's content accordingly in real-time
Yes
More?
1095
No
END
1099

Fig. 10


Real-Time Multi-Channel Ad Tracker Routine
1100
Fig. 11
1105
Receive indication of ad or other content to track
No
Past displays?
1110
Yes
1115
Determine on which casts and at what times the ad or other content has recently been displayed based on STB events retrieved from event db or on information retrieved from Content Provider
1120
No
Monitor Future displays?
Yes
1125
Request Audience Tracker to notify of events related to display of content and/or request Content Provider to notify of display of content
1130
Receive and store indications of displays for a specified time
1135
For each display of the content, retrieve related events from event db
1140
Determine demographics and times of each display
1145
Retrieve information related to preferred or required factors related to display of the content
1150
Determine based on previous displays and display factor information how/whether content should be displayed immediately or in near future, and notify Content Provider to act accordingly
1195
Yes
More?
No
1199
END

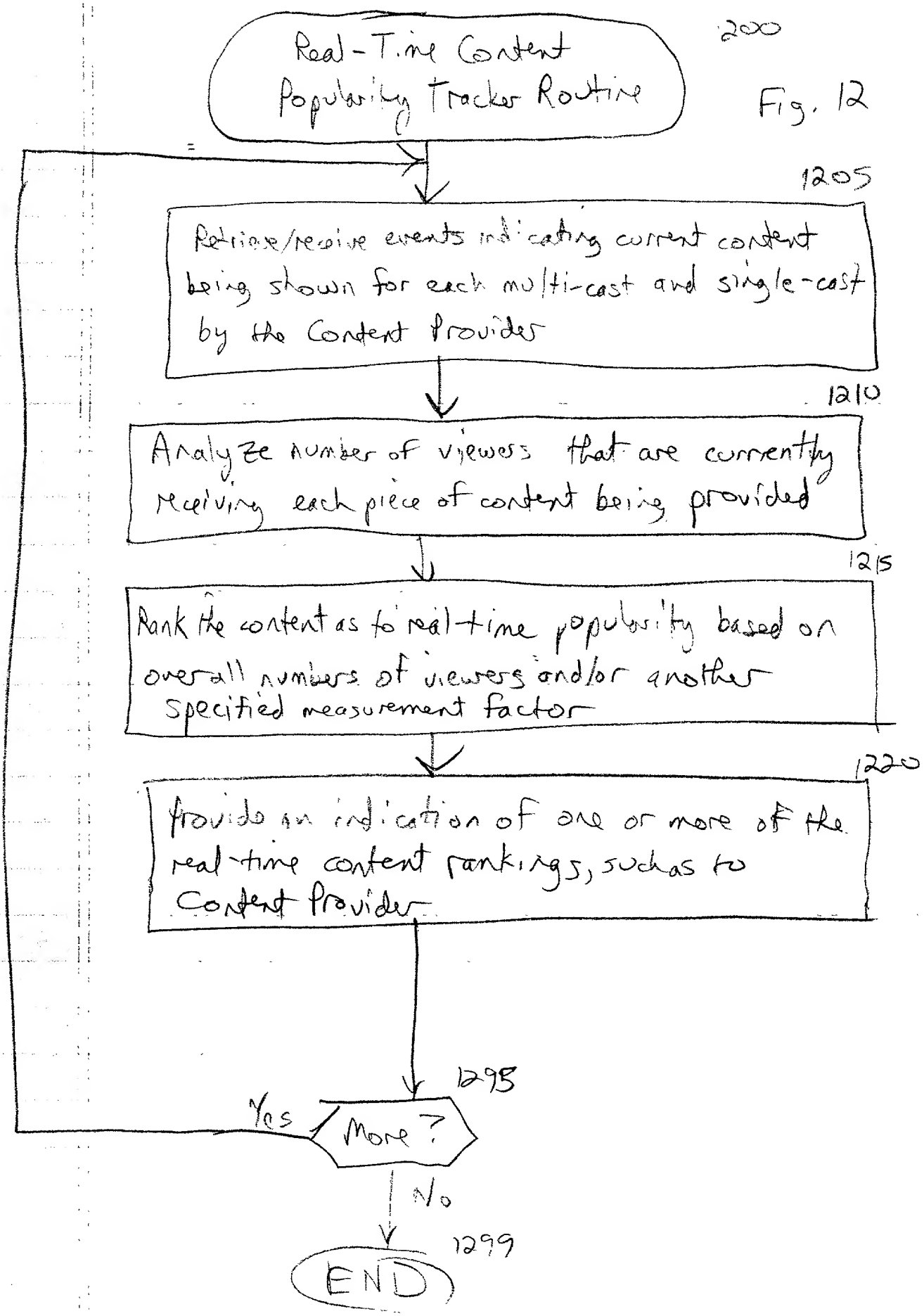
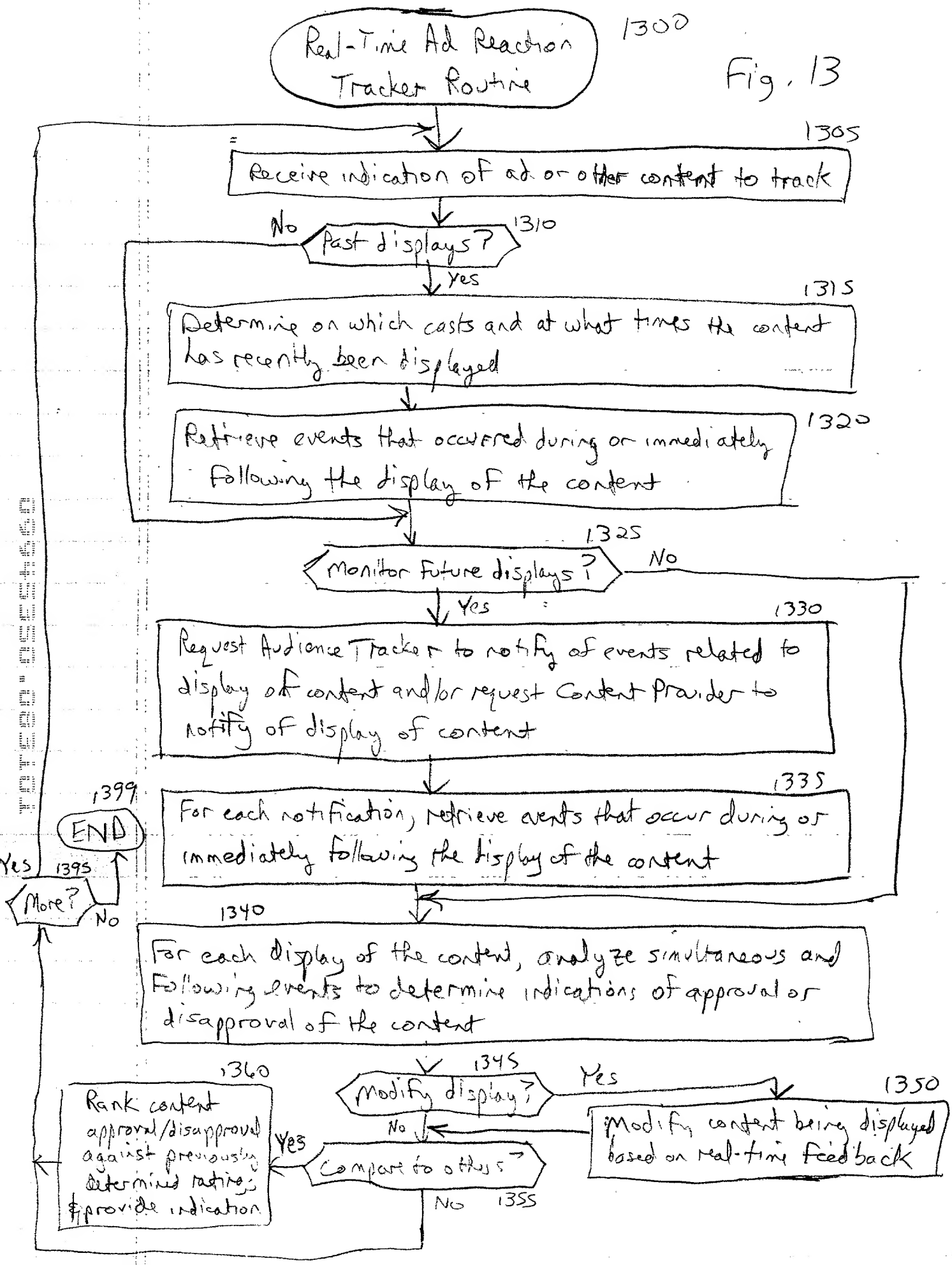

Real-Time Content Popularity Tracker Routine
200
1205
Retrieve/receive events indicating current content being shown for each multi-cast and single-cast by the Content Provider
1210
Analyze number of viewers that are currently receiving each piece of content being provided
1215
Rank the content as to real-time popularity based on overall numbers of viewers and/or another specified measurement factor
1220
Provide an indication of one or more of the real-time content rankings, such as to Content Provider
1295
More?
Yes
No
1299
END

Fig. 12


Real-Time Ad Reaction Tracker Routine
1300
Fig. 13
1305
Receive indication of ad or other content to track
1310
Past displays?
No
Yes
1315
Determine on which casts and at what times the content has recently been displayed
1320
Retrieve events that occurred during or immediately following the display of the content
1325
Monitor future displays?
No
Yes
1330
Request Audience Tracker to notify of events related to display of content and/or request Content Provider to notify of display of content
1335
For each notification, retrieve events that occur during or immediately following the display of the content
1340
For each display of the content, analyze simultaneous and following events to determine indications of approval or disapproval of the content
1345
Modify display?
Yes
1350
Modify content being displayed based on real-time feedback
No
Compare to others?
Yes
No
1355
1360
Rank content approval/disapproval against previously determined ratings & provide indication
1395
More?
Yes
No
1399
END

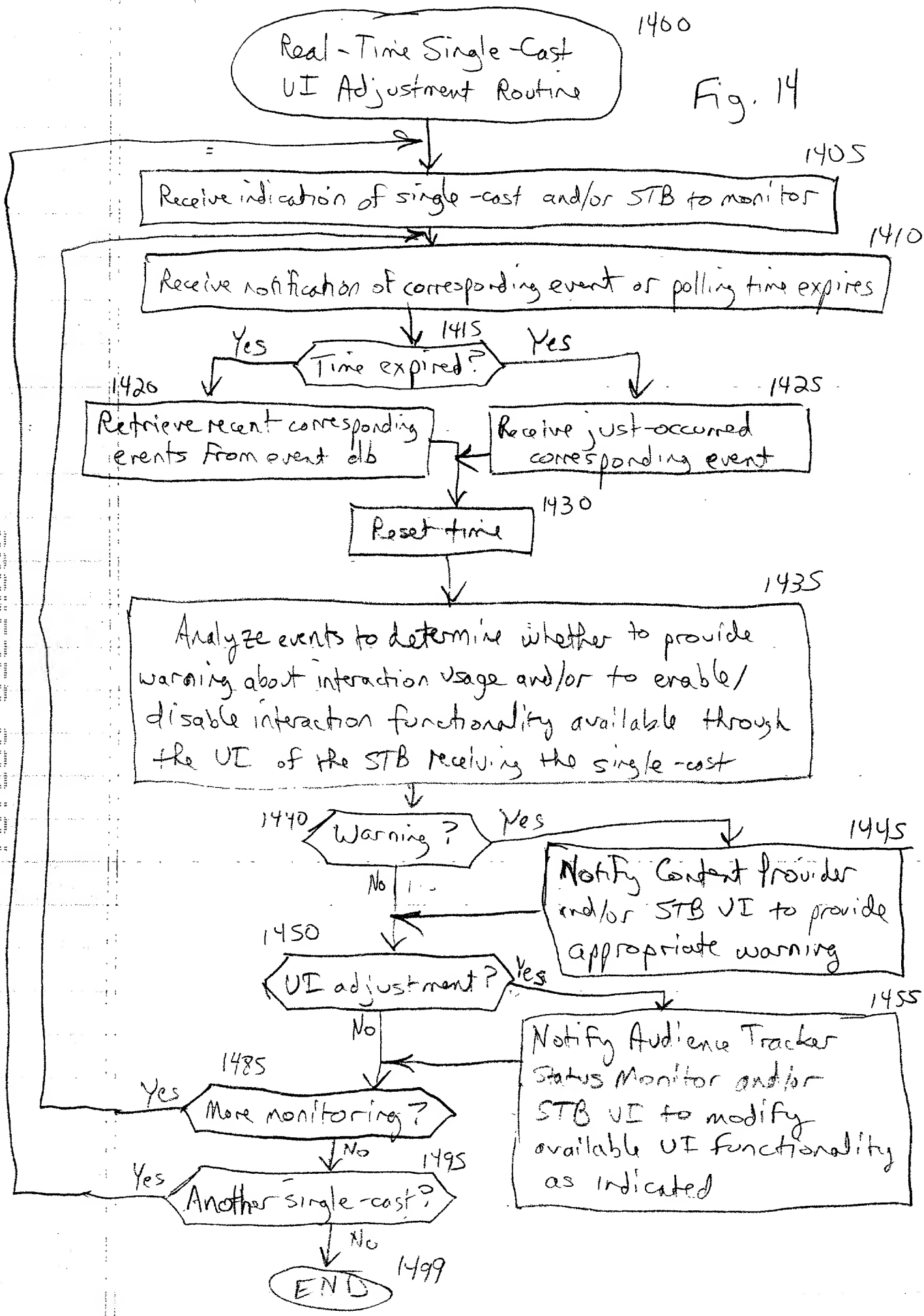

1400
Real-Time Single-Cast UI Adjustment Routine
1405
Receive indication of single-cast and/or STB to monitor
1410
Receive notification of corresponding event or polling time expires
1415
Time expired?
Yes
Yes
1420
Retrieve recent corresponding events from event db
1425
Receive just-occurred corresponding event
1430
Reset time
1435
Analyze events to determine whether to provide warning about interaction usage and/or to enable/disable interaction functionality available through the UI of the STB receiving the single-cast
1440
Warning?
Yes
1445
Notify Content Provider and/or STB UI to provide appropriate warning
No
1450
UI adjustment?
Yes
1455
Notify Audience Tracker Status Monitor and/or STB UI to modify available UI functionality as indicated
No
1485
More monitoring?
Yes
No
1495
Another single-cast?
Yes
No
1499
END

Fig. 14